

# The case of artisanal mining in Bolivia: Local participatory development and mining investment opportunities

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## Abstract

*Despite the buoyant expansion of Latin America's mining sector, the small-scale mining sub-sector remains marginalized. For many countries with small-scale mining resources, the way forward to sustainable mining development is not clear. Activities, in far too many cases, have led to environmental damage, social inequity and political violence among mining communities. This article, through a case study of the Bolivian Altiplano, seeks to advance the understanding of the conditions that drive mining communities into the chain of events of impoverishment associated with environmental damage. It also examines the opportunities for sustainable human development among these communities. In Bolivia's mining sector, social inequity is pervasive and holds the mineral resources captive. This situation is further aggravated by the fact that solutions, in the short term, are uncertain. Unresolved social inequity compromises foreign direct investments since social considerations are becoming increasingly important to mining corporations when deciding whether to invest. This article outlines a preliminary strategy to move forward on social inequity. The strategy revolves mainly around implementing alternative sustainable livelihoods with the participation of the government (central and local), the private sector, NGOs and donors as facilitators and partners. Its aim is to reduce the number of families eking out a living from artisanal mining in order to enhance the viability of small-scale mining. It is hoped that, as social inequity decreases throughout the sector, the increased stability will enable stakeholders to consider foreign direct investments within the framework of the country's sustainable human development goals.*

*Keywords:* Artisanal mining; Sustainable livelihood; Sustainable human development; International mining investment; Local economic development; Participatory approach; Bolivian Altiplano

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## 1. The issues

Globalization has become increasingly pervasive in recent years, with the mining sector providing a typical example of its scale and content. Today no country, at least in theory, is off-limits to foreign direct investment in mining. Countries' policies on foreign investment have moved in cycles.<sup>1</sup> Experienced observers (Crowson, 1997) note that current trend has clear parallels with the 19th century mining expansion. National governments are now revamping legislation, especially mining codes and competitive tax systems, to create an enabling environment for private investments, while becoming sensitive to environmental concerns. The growth of foreign direct investment in minerals is strong in Latin America, in line with a revitalization of the mining sector in

recent years. While in the 1980s Chile led the way, in the 1990s, mining was a strong component in the economies of Bolivia, Chile, Guyana, Jamaica, Peru and Surinam, accounting for between 5 and 50% of GDP and over 25% of export revenues. Exploration investments in the region increased by 130% in the last half of the 1990s. If Chile is excluded, this figure increases to 500% (World Bank, 1999).

In spite of the expansion the mining sector in Latin America, small-scale mining remains marginalized, and for many countries how to make small-scale mining more sustainable remains unclear.<sup>2</sup> A recent study conducted by the

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<sup>1</sup> It has been suggested that the period 1960 to 1970 was the decade of nationalization and creation of state-owned enterprises based on the principle of sovereignty over natural resources. From 1970 to 1980 was the decade of powerful state-owned companies. The 1990s gave rise to the privatization of state-owned companies; hence, the emergence of prosperous private mining companies using the strategy of large-scale mining supported by low-cost mining through advanced technology (see K. Sawada, nd).

<sup>2</sup> Although mineral resources development appears ill fitted to the concept of sustainable development, mining can lead to sustainable development of a community in the long term in the following circumstances: (1) exploration for additional mineral resources continues, as existing deposits become depleted; (2) technological innovations use more efficient exploration and extraction techniques to bring lower-grade deposits into production and reduce environmental degradation; (3) environmental protection is realized through: environmental impact assessment during project appraisal; training and technology transfer at the mine site; and information dissemination and education campaigns; and (4) the circumstances of future generations are improved through utilization of mining proceeds for social and economic development of the community (Sawada, 1998, in UNDP, 1998b).

Economic Commission for Latin America and the Caribbean (ECLAC, 2000) concluded that the progressive retrenchment of government from the mining sector has turned the attitude of local populations from passive to active resistance. Mining communities have heard promises of better economic conditions for several decades; they now want to have access to those resources that will meet their pressing needs.<sup>3</sup> Another study (ILO, 1999 cited in ECLAC, 2000) observes that there has been a considerable increase in small-scale mining activities in 35 countries reviewed in Asia, Africa and Latin America. In certain cases, the increase has been as much as 700%, but on the average, it has been between 10 and 20%, as compared with 1993. These mining activities are characterized by use of labour-intensive methods of exploitation that entail rudimentary mechanization leading to low output. This brings about a situation characterized by unacceptable levels of environmental damage; informal legal procedures; unorganized management; low quality jobs; and low fiscal revenues. The study estimates that this trend has increased in Latin America during the past 20 years (ECLAC, 2000; World Bank, 1995).

In certain cases, this situation has led to weakened government presence and active resistance on the part of local populations, resulting in widespread lawlessness. In other cases, social inequity among mining communities has held the mineral resources captive. The overall result has been increased political violence and continued argument over mining rights among authorities, mining investors and local communities. These conditions in the countries concerned compromise the potential for sustainable development of mining communities within the framework of human development goals.

This article, through a case study of the Bolivian Altiplano, seeks to:

- Advance the understanding of the conditions that drive mining communities into increasing impoverishment associated with environmental damage; and
- Examine the opportunities for sustainable human development among these communities.

The rising expectations common to developing societies also haunt Bolivia's mining sector, such that the mineral resource has become captive of the sector's social inequity. This was illustrated by the tin crisis in the 1980s. In 1985, when the state mining company, COMIBOL, abandoned direct exploitation of mineral resources, its labour force shrunk from over 25,000 to 4,000. Another 6,000 workers

<sup>3</sup> It is no longer safe to assume local communities surrounding mining sites will observe agreements made between foreign mining executives and the central government. Therefore, mining companies anticipating the opportunities for direct foreign investments face major challenges. If a mining company is going to thrive, so must the communities in which it does business. As discussed below, a major mining company must become a partner in local economic development, not dominate it; this way, when the mining company leaves, the community's economic development is sustainable.

were laid off from private mines (Nash, 1992). Some desperate workers were lured to accept settlement schemes in tropical areas, while others migrated to the coca producing region to find work as labourers. The bulk remained and consolidated the process of small-scale mining, in some cases under cooperative arrangements. The miners' hunger and misery were the heaviest price paid during the tin crisis of the 1980s (Nash, 1992). In the 1990s, violence erupted among Bolivian mining communities, still striving for access to the benefits flowing from the country's mineral resources. In 1996, the Altiplano communities of Amayapampa and Capasirca witnessed the seizure of the local mine by workers to press their demands for a share of benefits from the operations owned by foreign capital in association with national interests. Armed police forced the miners out of the mine. Nine miners and one policeman lost their lives (Centro de Estudios y Proyectos, S.R.L. or CEP, 1999).<sup>4</sup> As argued below, political violence stemming from social inequity holds Bolivia's mineral resources captive and at the same time, opportunities for sustainable human development are compromised.<sup>5</sup>

The analysis of the case study proceeds in the following way:

- To consider the historical evolution of mining in the Bolivian Altiplano with particular reference to mining communities;
- To examine the cross-sectoral nature of local economic development supported by participatory and sustainable livelihood approaches and resulting opportunities for sustainable human development among mining communities.
- To outline a preliminary strategy that can reduce social inequity among mining communities. The key to underpinning this strategy is implementing alternative sustainable livelihoods with the participation of government (central and local), the private sector, NGOs and donors as facilitators and partners. The goal is to reduce the number of families eking out a living from local deposits in order to enhance the viability of sustainable small-scale mining. As social equity improves throughout the sector, the consequent increased stability will improve the ability of stakeholders to consider foreign direct investments within the framework of sustainable human development.

<sup>4</sup> This particular incident is not an isolated event. A glimpse of the series of violent eruptions between organized miners and the various governments throughout the last decades can be obtained in Nash's work (1979, 1992a, 1992b).

<sup>5</sup> It has been estimated that, prior to the 1980s tin crisis, the core number of mine workers was no more than 28,000 representing 2% of the total work force (Nash, 1979). After the closure of the COMIBOL mines in 1985, the number of workers associated with loose cooperative arrangements shot up from 20,000 to about 40,000. More recently, it has been suggested that approximately 500,000 people make their living directly or indirectly from small-scale mining operations (Hentschel, 1998), including the population of communities surrounding the mining centres of Catavi, SigloXX, Uncía, and Llallagua.

## 2. The historical evolution of mining in Bolivia: a benchmark

Before the establishment of the Spanish Empire, silver and gold were mined in the Altiplano.<sup>6</sup> In 1545, Diego de Villarreal started the first large-scale silver exploitation in Potosí, at the Cerro Rico mine.<sup>7</sup> By 1615 Potosí reached a population of 150,000, thus fleetingly becoming one of the largest and most prosperous cities in the world (Braudel, 1979). It has been estimated that between 1545 and the present, Cerro Rico has produced more than 2 billion ounces of silver (Arpin, 1999).

As the world silver market began to collapse in the early 1890s, mining gradually shifted towards tin. Found in association with silver, tin did not become an important product until the end of the 19<sup>th</sup> century when demand for this commodity soared in all industrialized countries (Thorp, 1998). Thus, by 1900 tin had completely superseded silver as Bolivia's primary export. The now-depleted tin deposit of La Salvadora was one of the richest deposits ever exploited. There are also known reserves of antimony, lead, zinc, tungsten and small quantities of gold.

Tin mining itself absorbed far more capital and produced more wealth than silver. However, mining development did not stimulate the growth of the national economy. Whereas the silver-mining elite had been almost exclusively indigenous Bolivian, the new tin miners were cosmopolitan. There were several foreigners and new Bolivian entrepreneurs. The most powerful was unquestionably the Bolivian tin baron Simon I. Patiño. The new companies that emerged became complex international ventures directed by professional managers. Patiño, in a move rare in Latin American capitalist circles, undertook vertical integration of his mining operations. Eventually, in 1916, Simon Patiño took control of the world's largest smelter of Bolivian tin, William, Harvey & Co., Ltd., in Liverpool, UK. After this time, Patiño resided permanently abroad, but remained Bolivia's dominant miner and finally its most powerful capitalist until his death in the 1940s.

Mining was capital intensive and employed primarily unskilled labour; national policies played a relatively small role. The Bolivian economy from 1900 to 1930 is a classic example of export-led growth. Tin exports increased

five-fold and Bolivia's share of world production more than doubled (Ayub and Hashimoto, 1984 cited in Contreras, 1990). Yet, the Bolivian Government did not extract significant taxes from the mining industry, despite the fact that it provided infrastructure for transportation, financed by foreign loans (Gomez, 1976). If it was expected that mine owners would invest their wealth from tin exports in the rest of the national economy, this never happened, as mine owners sent their profits abroad. When taxes were extracted, it was at considerable transaction cost, and much of the revenue was wasted in prestige projects and corruption (Thorp, 1998).

The analysis by Contreras (1990) confirms that, in the 1930s, the barrier to national economic growth was the absence of investment opportunities for private capital and the squandering of public funds through corruption and investments in unproductive projects. This may have been exacerbated by the fragile fabric of institutions, and legal instruments, especially, which hindered investments. For example, Patiño laid plans for colonization of the eastern wetlands to develop supplies of food and wood for the mining operations, with a railway to bring the goods, but the Bolivian Congress refused to grant the concession (Thorp, 1998). Yet, the Government built railways to other regions with less economic potential to placate the vested interests of the upper class and railway contractors with illicit enrichment schemes. These barriers persist to a greater or lesser degree up to the present day.

By 1950, three families (Patiño, Hirsch and Aramayo) controlled the major mining areas. In 1952, the major mines were nationalized, and the national mining company (COMIBOL) came into existence. During the first few years, the Government extracted mining taxes that resulted in difficult conditions. In 1957, after a severe inflation caused by the government deficit, inflation came under control through a stabilization plan. COMIBOL's output declined considerably. It became tax-exempt, and large investments from foreign loans were essential. It was expected that COMIBOL, after recovery, would make important contributions to the national economy. Unfortunately, this did not occur. The growth in the petroleum industry and in the energy, transportation and construction sectors during the 1980s was financed by external sources.

Thus, both before and after 1952, the surplus from the mining sector that was to have been invested in the national economy, was lost. Although by 1956 there was a potential surplus, COMIBOL wastefully consumed it (Gomez, 1976). As compared with the three other major tin producing countries, Nigeria, Malaysia and Indonesia, Bolivia had the lowest-grade ore and the highest transportation cost. It was therefore a high-cost tin producer, and particularly vulnerable to changes in demand. By the mid-1980s the tin cartel collapsed and with it the price of tin. In 1985, the Government instituted a new economic policy, resulting in the re-structuring of COMIBOL. Uneconomical mines were closed, and their operations transferred to the private sector

<sup>6</sup> Klein (1982) provides a perceptive and learned analysis of the economic history of mining as it shaped the main institutional features of Bolivia from approximately 800 BC to 1980. Three findings are key to understanding the potential and constraints of mining communities: (1) Bolivia is a complex amalgam of cultures and ethnicities in which important elements of Western and non-Western norms co-exist; (2) it remains today a nation dominated by its peasantry; and (3) the peasantry of primarily Quechua and Aymara (Indian) origin have served Bolivian society as miners, farmers, workers and soldiers.

<sup>7</sup> In 1557, Bartolomeo de Medina applied the innovative amalgamation process in which silver ore was treated with mercury in the Cerro Rico mine in Potosí. From 1571 on, silver export increased ten-fold and reached its peak by 1620, thus coinciding with the age of Spanish Imperialism (Braudel, 1975).

through joint ventures. More than 80% of the labour force was laid off. To ensure that the new management is environmentally responsible, COMIBOL now undertakes environmental audits. Flow pollution is the responsibility of the new operator, but stock pollution (environmental liability) remains the responsibility of COMIBOL or the Bolivian Government (World Bank, 1999).

The private sector responded positively to the government policy by increasing investments. It reduced the production of tin and increased the production of other minerals, such as zinc, silver, lead and later gold. In 1985, COMIBOL was the source of 51% of the value of Bolivia's mines; by 1998, it was responsible for only 5.4% (Fox, 1999). At the same time, mineral exports remain important for the national economy, accounting for 48% of total export earnings in 1997 and 43% in 1998 (Fox, 1999). The decline is a consequence of lower commodity prices, part of a wider deterioration in the national terms of trade.

The current low level of exploration is far below the country's mining potential (Arpin, 1999). Although it is known that the Precambrian shield in the eastern region of Bolivia is one of the best prospecting sites, it remains virtually unexplored. In 1996 the company, Andean Silver found important deposits of silver and zinc close to the municipality of San Cristóbal in Potosí in the western region. Reserves are estimated at 509 million tons with a grade of 62.2 g/t for silver and 1.58% for zinc. This is a world-class deposit. In April 1999, the Canadian company, Vista Gold announced that it would defer the exploitation of its gold mines at Amayapampa and Capasirca, also in Potosí, due to the decline in the world gold price.

Despite the expansion of mining in Latin American countries and Bolivia's clear geological potential, the country has not attracted important foreign investments. In 1998, foreign investment was about US\$ 360 million in Bolivia, compared to US\$ 4 billion in Peru. Argentina, without a mining tradition, forecast a level of foreign direct investment of nearly US\$ 4.8 billion for the period 1996–2005 (Arpin, 1999). Bolivian authorities claim that limited infrastructure development, small market size (8 million inhabitants), and an uncompetitive fiscal regime dissuade foreign investors.

The size of the domestic market has little bearing on mineral extraction and export potential. However, Bolivia's geography, characterized by steep mountains and seasonally flooded plains, make transportation difficult. Nonetheless, though the existing infrastructure is not optimal, it is not a major constraint. In the western region, the main railway system was built exclusively to serve the mining sector. It links the major mining centers with the ports of Antofagasta and Arica in Chile and Matarani in Peru. In the eastern region, Santa Cruz is the hub for rail links to Corumba in Brazil and with Argentina via Yacuiba. Road transport has developed dramatically in recent years, linking the highlands with the eastern region. Bus and truck services on unpaved roads connect numerous towns in the highlands. There is a paved highway connecting La Paz-Oruro-Cochabamba-Santa

Cruz-Montero, and mining companies can construct access roads if the investment justifies it.

The new mining code (Fox, 1999) introduced greater transparency of tax liabilities with the liberalization of access to exploration and mining concessions for both local and overseas companies. The tax system is based on a profit tax of 25% and complementary (minimum) tax. The latter is applied to the gross sales value of the mineral, with a rate that varies according to the mineral and its price. For gold, the rate varies between 4 and 7%, while for silver the range is between 3 and 6%. This tax is actually levied only if the amount paid as profit tax is less than the complementary tax, in which case the company has to pay the difference. When the mineral is exported, an amount equal to the complementary tax rate is withheld. The amounts withheld are distributed to the local governments (prefectures). At the end of the fiscal year, the profit tax is calculated.

It appears from the above that neither Bolivia's fiscal regime, nor the level of infrastructure development, necessarily constitute obstacles to foreign investments. Rather, it is the political violence resulting from social inequity that compromises sustainable development.<sup>8</sup>

### 3. The social structure of Bolivian mining communities

The social aspects of production in the Bolivian Altiplano have been persistently influenced by the ecological context and the region's specific historical evolution. As the Altiplano's resource endowment is limited, it has taken considerable human ingenuity to survive in this region. Most of the mines are situated in the mountainous eastern region, one of the highest elevations in the world to be inhabited. It constitutes Bolivia's heartland and is dominated by two great parallel ranges of the Andes. To the west along to the border with Chile is the Cordillera Occidental, containing several active volcanoes. To the east is the Cordillera Oriental, with its spectacular northern section near La Paz, the Cordillera Real, an impressive line of snow-capped peaks, some exceeding 6000 m. Between these ranges lies the bleak Altiplano.

The Altiplano is a relatively flat-floored depression, some 1000 km long and 175 km wide, at elevations between 3600 and 3800 m. The surface soil is composed mostly of water- and wind-borne deposits from the bordering mountains. The Altiplano slopes gently southward, its evenness broken by occasional hills and ridges. Its margins are characterized by numerous spurs and interlocking alluvial fans, which have built an almost continuous plain of gentle grade, lying at the foot of the mountains. Lake Titicaca occupies the northernmost basin; dominant vegetation are small trees and shrubs, and temperatures around the shores of the lake

<sup>8</sup> This was one conclusion of a mid-term evaluation conducted by CIDA, Ottawa (see CIDA/ACDI, 2000).

are moderate. The area receives adequate rainfall for the cultivation of crops without irrigation; corn, potatoes, wheat and other crops can be grown at an elevation of 3900 m.<sup>9</sup> To the south are Lake Poopó and the Coipasa and Uyuni salt flats, an extremely arid zone. The desolate expanses of desert yield important mineral deposits of copper, silver, tungsten and tin. Livestock of economic importance particular to the zone include the llama (*Lama glama*) and the alpaca (*Lama pacos*) both of which are now bred for wool and serve as pack animals. Also the ubiquitous *cuy* or guinea pig (*Cavia porcellus*) provides animal protein for human consumption at reasonable production cost as it can feed from wild pasture practically without water.

Though the Altiplano constitutes only one-tenth of Bolivia's total land area, earlier civilizations showed a preference for settlement in this region. The land can be cultivated as is, and appears more fertile than the hot, wet plains. Archaeological evidence suggests that agriculture in the Central Andes dates back to 2300 BC (Kosok, 1965). In fact, the potato was domesticated in this region. A thousand years before the Spanish Conquest, the Central Andes had the most developed agricultural and irrigation systems in all of South America, with the densest population south of Mexico, and the most efficient system of overland transportation in the western hemisphere. The combination of these features enabled the emergence of true urban centres, a class system, and a strong bureaucracy to run the state-controlled irrigation works over 1200 years ago (Mitchell, 1981).

One of the most important early kingdoms of the Central Andes was the Tiahunaco, situated in the Altiplano near the southern shore of Lake Titicaca. Its origin and development are not fully understood. It exerted considerable influence over a wide area around the Central Andes from AD 250 to 750 (Murra, 1975). Archaeological evidence reveals that its influence was a result of its remarkable agricultural system (Smith *et al.*, 1981), based on a farming method known as the raised-field system. It consisted of raised planting surfaces separated by small irrigation canals. This was designed so that the canals of the Altiplano retained the heat from the intense daytime sunshine and thus kept the crops from freezing during frosty nights. Algae and aquatic plants that accumulated in the canals were used as organic fertilizer on the raised fields. Recently, this farming system has been revived with considerable success in increasing agricultural output.

It is not surprising, therefore, that in much of the northern Altiplano, subsistence farming remains predominant today. A land reform introduced in 1953 unwittingly brought about land fragmentation. However, a positive development has been the growth of new roadside market towns in

the northern Altiplano. Here, peasants are able to sell their farm surplus and a wide range of other commercial goods. These are carried to market by foot, bicycle or truck from nearby valleys.

The Cordillera Real descends to the eastern plains through a rainy and heavily forested belt, the Yungas, with rugged terrain, deep valleys and gorges separated by high ridges. During the 1970s and 1980s, an unprecedented expansion of coca (*Erythroxylum coca*) cultivation took place in the eastern low plains of Chapare, in response to the illegal international market for cocaine. Native settlers have chewed coca leaves for centuries, as a relief against cold and fatigue. Due to the lucrative trade, peasants soon found that no other crop could compete with coca for profitability. Many laid-off miners also migrated to the area to find work with the production and processing of cocaine. By the early 1990s, it was estimated that cocaine worth US\$ 5 billion was leaving Bolivia. Although some labourers increased their income, the untold riches of the coca trade profits fell mainly to illegal traders.

Not all peasants joined the cultivation of coca. The bulk remained in the Altiplano and continued to eke out a living, predominantly from smallholdings (*minifundio*), where the typical returns from labour and land were insufficient to cover the subsistence needs of a family (Barraclough, 1973). With little or no labour demand, the Altiplano's rural unemployment and underemployment are pervasive. Very few peasants can find temporary employment in commercial farms either in the valleys or the Amazon wetlands, and the urban centres have no demand for unskilled peasant labour. For many years, one of the few means of survival for this population has been moving to a mining area and becoming miners.<sup>10</sup> More often than not, whole families become involved in mineral extraction operations, using crude methods.<sup>11</sup> Thus, this is the origin of the exploitation of local mineral deposits by individuals and families, a tradition deeply embedded in the region's historical and ecological setting.

#### 4. The opportunities of small-scale mining

##### 4.1. Scope and context

Small-scale mining is multifaceted. The Berlin Guidelines (United Nations & GTZ, 1992) contend that small-scale mining has generated significant employment opportunities, through extraction of numerous small, otherwise unexploitable mineralizations. ILO (1999; cited in ECLAC, 2000)

<sup>9</sup> Other food crops domesticated in this zone, with considerable nutritive value, which are cultivated at elevations higher than 4000 m, include: oca (*Oxalis tuberosa*), quinoa (*Chenopodium quinoa*), cañihua (*Chenopodium pallidulae*) and others.

<sup>10</sup> A similar pattern has been observed in the Central Andes of Peru (Fonseca, 1973).

<sup>11</sup> UNDP (nd) suggests that women represent 10 to 50% of the total labour force and the use of child labour is common. During the 1950s, some of the COMIBOL mines and other companies absorbed seasonal labour from the peasantry, but these conditions have ceased since more than 25 years.

estimates that the number of workers involved in small-scale mining could be as high as 13 million worldwide and 1.6 million in Latin America and the Caribbean. To estimate the economic value of this activity, ECLAC (2000) suggests assuming a monthly salary of US\$ 150 per worker. Based on this calculation, small-scale mining contributes more than US\$ 2 billion yearly to the economy of the continent. In the context of regional economies, this is an important flow of funds. In Brazil, small-scale gold miners (*garimpeiros*) have been able to modify government policies and have consistently produced as much miner as formal companies, or more. However, on the downside, small-scale mining is also a source of political violence and environmental degradation.

There is no universal definition of small-scale mining. Sometimes the definition is based on volume of output (Colombia), sometimes the capital invested (Argentina and Thailand), the number of workers (Chile, Pakistan and USA) or even the technology applied. In the Bolivian Altiplano, conditions are complex and range from seasonal family-based exploitation of local deposits, to loose cooperatives of former COMIBOL *cuadrilla* or *pirquiñero* miners, to mines owned by single entrepreneurs as proprietary businesses with more or less permanent labourers, to formally owned small corporations with shareholders.

The *pirquiñero* system refers to mining operations comprised of a dozen or more labourers working independently under a foreman. Sales contracts may be concluded with companies for the extraction and sometimes also processing of the mineral in hand-operated facilities. The proceeds are distributed equitably among the workers, giving recognition to the level of skill. On the other hand, a typical large mine, owned by an entrepreneur, can extend over several km<sup>2</sup>, with a number of passages (adits) into the ore body, a haulage system (rail or road), usually one or more concentrator plants, a number of waste heaps for mine and concentrator wastes and perhaps a tailings dam (World Bank, 1995). Hard rock mining in the Altiplano has traditionally been underground with low levels of mechanization. The major economic ore bodies consist of complex non-ferrous metals, usually with a sulphide matrix. Extracted ores usually undergo some level of processing or concentrating near the mine.

Processing facilities may range in size from very small operations relying on primitive techniques to large relatively modern smelters (World Bank, 1995). A national tin smelter was built in the late 1960s with financial aid from Russia and Eastern Europe. Large mines normally include offices, workshops, schools, and a health dispensary for the personnel. When the mine closes, however, it takes these amenities with it. This brings additional distress to the laid-off workers, as no alternative employment exists for their services. Therefore, internal migration results.

The potential and constraints of small-scale mining can be analyzed and classified according to management competencies, which are central factors for sustainable mining development (ECLAC, 2000). These competencies are: (1)

environmental protection, (2) partnership for local development and (3) the use of technology. Within the framework of the mining cycle (i.e. business planning, followed by exploration, exploitation of the mineral resource and mine closure),<sup>12</sup> specific environmental/legal regulations for sustainable mining development apply to each phase. The degree of management commitment to environmental protection is reflected by its adherence to the regulations applicable to each phase. The capacity of management to build partnerships for local development depends on its ability to interact positively with regional or national government authorities, the community or the private sector to make mining economically equitable. Finally, the use of technology to meet environmental regulations, can range from large-scale operations supported by low-cost advanced technology to rudimentary techniques. In terms of these characteristics, it is possible to distinguish three types of mining organizations in the Altiplano, either private or corporate.

#### 4.2. Types of mining operations

**Formal mines.** This category consists of private, profit-oriented, corporate organizations working effectively within government regulations, interacting with local communities, and participating in the globalization process. They possess legal, administrative and technical staff. They follow the mining cycle to optimize economic returns by using technology to increase productivity, reduce operating costs, and adhere to regulations and implement schemes to avoid environmental degradation. In the Altiplano, there are currently two companies of this type: Inti Raymi S.A., and Compañía Minera del Sur (COMSUR). Inti Raymi S.A. has been operating the Kori Kollo mine for nearly 10 years. In 1998, it produced 336,000 oz of gold and 968,000 oz of silver. Compañía Minera del Sur (COMSUR), operating the former COMIBOL mines of Bolívar in the Precambrian shield, and Porco, as well as the gold mine Puquio Norte (Arpin, 1999). It is associated with foreign capital and new technology, with particular emphasis on zinc and gold (World Bank, 1999). This capital-intensive approach reduces the demand for unskilled labour. The company has a good environmental record, maintaining the established standards, and in many cases exceeding them, as revealed in a recent review of the sector (World Bank, 1999).

Certain of the mining units organized under *Asociación Nacional de Mineros Medianos* could also belong to this category of operation, such as proprietary businesses owned by single entrepreneurs with mostly local, permanent labourers.

**Organized small-scale mining.** Although small-scale mining is mainly engaged in as a means of economic sub-

<sup>12</sup> These refer to standard mining engineering/economic procedures to ensure environmentally responsible and profitable production. The Berlin guidelines (UNCTD & GTZ, 1992) and ECLAC (2000) review these matters in detail.

sistence, miners often seek quick riches without government interference — even though they at the same time demand gratuitous and permanent support from the same government. Management capabilities are low and levels of formal education/training generally limited. The adherence to the environmental and legal requirements of the mining cycle by this category of mining is irregular. Operations are highly vulnerable to legal action due to lack of knowledge of proper mining procedures. However, miners are capable of conducting modest management obligations in technical, social, tributary and environmental matters. The remaining COMIBOL mines and other medium-sized mining operations belong to this type. Some of them absorbed the 1985 shock by downsizing and closing certain mines. Currently, their importance has decreased considerably. Many operations need substantial investment just to keep functioning. This sector has a poor record of observing environmental regulations; water recycling systems and tailings dams previously in operation, and which later deteriorated, have frequently caused spills of effluents into the environment (World Bank, 1999). Some operations are associated with regional organizations, *Cámara de Minería*. Those of La Paz and Oruro have been actively engaged in organizing themselves to take advantage of technical assistance and potential linkages for investments in exploration with Canadian junior mining companies (CIDA, 2000).

Another group belonging to the category of small-scale mining are miners loosely organized under cooperative arrangements. These resilient workers took the heaviest blow during the crisis. With primitive technology and intense use of manpower, they increased the production of all minerals — gold, zinc, silver as well as tin (World Bank, 1999). Some international organizations are making heroic efforts with these cooperatives to rehabilitate former COMIBOL mines.<sup>13</sup> Sometimes, used equipment is rented or purchased from COMIBOL to make the operation economically viable.

Historically, traditional cooperatives have co-existed with former small and medium COMIBOL mines, working tailings and abandoned sites. Many artisanal miners now work under cooperative arrangements, although the cooperatives serve mainly as labour organizations, rather than as economic entities exploiting resources. A cooperative is composed of teams (*cuadrillas*), each of which may have up to 10 workers. The team is independent of the cooperative in its production, processing and trading decisions. A cooperative represents the teams, allocates the deposits for exploitation and provides certain services (providing e.g. compressed air, trading, etc.) in exchange for a percentage of the net value of their sale. Up to 1985, there were approximately 20,000 workers associated with cooperatives, but after the closure of COMIBOL's mines, the number of workers seemed to have swelled to about 40,000. In their interaction with local communities, cooperatives are often

a source of conflict, and sometimes of violence, among communities, workers and authorities.

**Non-organized small-scale (artisanal) mining.** This type exhibits diverse characteristics and needs. Little information is available on this category. Some miners exploit local deposits as a means of subsistence for themselves and their family. Often the entire family, including wife and children, work. Miners in this category may also work seasonally, exploiting local deposits during the dry season and returning to agriculture during the rainy season. These miners have no management capability to speak of and little or no education or training. They use rudimentary tools, and often work on lower grade deposits adjoining larger mines, or rework tailings. Often referred to as artisanal miners, they have limited interaction with community organizations or local government.

By the late 1990s, it was claimed that the number of artisanal miners had been shrinking, undoubtedly due to the depletion of reserves, especially old tailings. This type of mining activity is labour intensive and takes place outside regulatory frameworks. Thus, there is little control over the safety of either the workers or the environment. This article concerns especially the last two categories of mining activities/miners discussed above: organized small-scale and non-organized (artisanal) types. For the sake of brevity, these activities are referred to as small-scale and artisanal mining, respectively.

The working conditions for both small-scale and artisanal miners are dismal. Life expectancy is barely 48 years of age, as silicosis is endemic. There are no statistical data to document the health conditions of these workers, though a descriptive account of the conditions suffered by women in the sector is available (CEPROMIN, 1996). Using autobiographies over a span of several decades, Nash (1979, 1992a) has made an important contribution by documenting the plight of these miners and their Sisyphean efforts to achieve better living conditions.<sup>14</sup>

Not surprisingly, most small-scale and artisanal miners operate without any system for the disposal of tailings or treatment of waste water. Their exploitation methods have caused severe damage both to deposits and the environment; they have often breached tailings dams in their efforts to extract additional gold, as well as ruined water recycling systems. Wittingly or unwittingly, they traditionally have developed their own economic and political enclave — decoupled from the rest of the economy. The disenfranchisement of this group and their isolation from the rest of the economy contributes to their poverty. As a consequence, their limited access to productive resources, not to mention education and health services, prevents them from enjoying opportunities for sustainable human development. Although

<sup>13</sup> For example, UNDP is financing *Programa de Reactivación del Occidente Boliviano* (BOL/95/011).

<sup>14</sup> The personal testimony of Juan Rojas, a Bolivian tin miner (Nash, 1992), and of Domitila (Chungara, 1981) a miner's wife and mother of seven children, provide an in-depth description of the sufferings and injustices endured by Altiplano mining communities.

both groups use rudimentary technology, there seems to be one difference between small-scale and artisanal miners: while small-scale miners appear to consciously accumulate some resources to reinvest in their venture, the primary goal of artisanal miners is only the survival of their family.

Certain ideologies suggest that proxy market mechanisms will work to diminish social inequity. However, at the subsistence level, different forces are at work. By increasing the efficiency of metal recovery from tailings, their subsequent reprocessing by artisanal miners would be even less likely; thus jobs would be lost. Similarly, if medium and small-scale miners were to implement closure plans, reprocessing work would no longer be available to artisanal miners (World Bank, 1999). The author believes that it is unrealistic to expect blind market mechanisms to solve social, or even economic problems.<sup>15</sup>

A multi-sectoral approach to foster an enabling environment for sustainable mining development appears a productive way forward. Small-scale and artisanal miners need to be linked up with the rest of the national economy and with society. They all must become partners in local economic development.

## 5. The challenge of local economic development<sup>16</sup>

Local development is a process that generates economic growth and distributes wealth equitably. It helps to empower the poor, rather than marginalize them. It regenerates rather than destroys the environment (UNDP, 1997). The lessons from rural development, during the past decades, highlight pitfalls and opportunities for the private mining sector to become a partner in local economic development, as the bulk of mining investments are located in remote rural areas.

A prerequisite for the success of local economic development is coherence between national policies and local development objectives. Also, local economic development must be designed so as to ensure that project components and activities meet perceived needs of disadvantaged groups. In most developing countries, the institutional framework is not designed to aid the rural poor. Therefore, it is necessary to ensure that the measures introduced are equitable, and that they do not have adverse effects upon disadvantaged groups. As a diagnostic phase, socio-economic studies should be capable of identifying sources of rural poverty in terms of access to resources, with special attention to the most vulnerable groups, such as women and indigenous

people. One must avoid the false distinction made between productive investments (i.e. equipment and tools) and social infrastructure (i.e. schools, health services). The level of human needs is such that without improvement in education, health, sanitation and other conditions, it is not possible to increase economic output.

The participation of the targeted population in the design of local development is indispensable. In this context, the differences between centralized and the decentralized institutional approach must be recognized. Whenever a central authority controls the formulation and execution of projects, the response of the local population is often muted and their participation almost non-existent. Experience points to the need for a two-pronged approach: a central authority coordinating local development policy, while at the same time, local authorities encouraging diversification and autonomy at the micro-regional level. When local populations participate in the development design, the ensuing projects are more likely to achieve the goals set for them (Lele, 1975; World Bank, 1988).

The participatory approach is of fundamental importance in the design of local development. However, while adequate local participation is a necessity, it is insufficient to guarantee success. Proper mechanisms for channelling the needs of the local population appear to be critical. Experience suggests that project designers should invite all relevant stakeholders from the local community (including women, youth, religious leaders, landless farmers, landed gentry and others) to participate in the decision-making processes of the project cycle.

### 5.1. *The challenge of the participatory approach to development*

The political realities of human development are now increasingly under the influence of the private sector, as the public sector shrinks. The participatory approach to development provides a cross-sectoral framework to encourage the private sector's involvement in local development efforts. It is the "means for wider participation by a population as a whole in production activities with an equitable share of the fruits of these activities".<sup>17</sup> As a consequence, the participatory approach is both the means and the goal of development. It is the means because it supports decentralized policies. It is a goal because it provides a framework within which responsible action by citizens can lead to sustainable development.

The notion of development partners has emerged because the application of the participatory approach to development requires a flow of resources (social services, technology, capital etc.) from outside the community as inputs into the development process. Because of the current globalization processes, a sizeable portion of these resources may come

<sup>15</sup> Although capitalism has supposedly triumphed, it is misguided to assume that the private sector has become good, the public sector bad, and the cooperative sector irrelevant. Mintzberg (1996) aptly examines this assumption based on complex structural issues requiring multi-faceted trade-offs among competing social interests.

<sup>16</sup> What follows is a preliminary policy framework to outline boundaries so potential stakeholders can focus their efforts. It is iterative and participatory in nature. It does not claim to be an all-encompassing answer to the problem under discussion.

<sup>17</sup> See OECD (1991). This view is also considered and endorsed in UNDP (1990, 1991, 1992).



from private sector investors. Accordingly, development now requires the association of many parties: government, the private sector, finance and development organizations, and the local population.

The participatory approach aims to revamp the concept of partnership by acknowledging the central role to be played by local populations. This is necessary because in the past, partnership was understood to involve exclusively governmental and developmental institutions, with only the latter acting mainly through public agencies. Without local control over funds, participatory policies cannot bring about a shared responsibility of local populations for development activities.<sup>18</sup>

In summary, a participatory approach channels the flow of outside resources into a society as development inputs. Through partnerships, local populations play a central role in the decision-making process. Local control over funds is vital to a shared responsibility in the development process.

### *5.2. The opportunities of the sustainable livelihood approach*

The specific conditions of small-scale and artisanal mining evoke its de facto nature. Because of the open access to areas with mineral resources, all stakeholders unwittingly suffer from the ‘tragedy of commons’. Essentially, too many people are exploiting too limited a resource. Although the first peasants that arrive at a resource-rich site may extract a reasonable livelihood, subsequent arrivals will meet with less success, and thus lower income. It is this low income, coupled with limited or no access to resources or investment opportunities, that brings about the use of rudimentary technology, unfriendly to the environment and unhealthy for the workers themselves. In the end, all concerned fall into the trap of impoverishment. One way out of these conditions is to foster alternative opportunities for sustainable livelihood.

A sustainable livelihood is one where activities, entitlements and assets by which people make a living do not decrease or deteriorate over time. Assets, in this context, are not only resources (land, water, common property etc.) but also social relations (social network, family, community, knowledge, etc.) and infrastructure (roads, bridges, market places, schools, etc.). By understanding the livelihood processes of a community, it is possible to frame strategies for their improvement.

## **6. What are the alternatives to impoverishment?**

In essence, several factors contribute to impoverishing small-scale and artisanal miners. Compounding the disenfranchise-

ment of the small-scale and artisanal miners, as outlined above, has been the cumulative effect of failed development policies (i.e. unfulfilled land reform and settlement schemes, natural disasters and crop failures). These factors have induced subsistence farmers to move into artisanal mining as a survival strategy. Although the impoverishment of the Altiplano mining communities should not be ascribed to the mining sector alone (World Bank, 1999), several negative effects have permeated society:

- unacceptable environmental practices;
- poor social/health and safety conditions;
- unlicensed mining and marketing; and
- uneconomic use of the mineral resource.

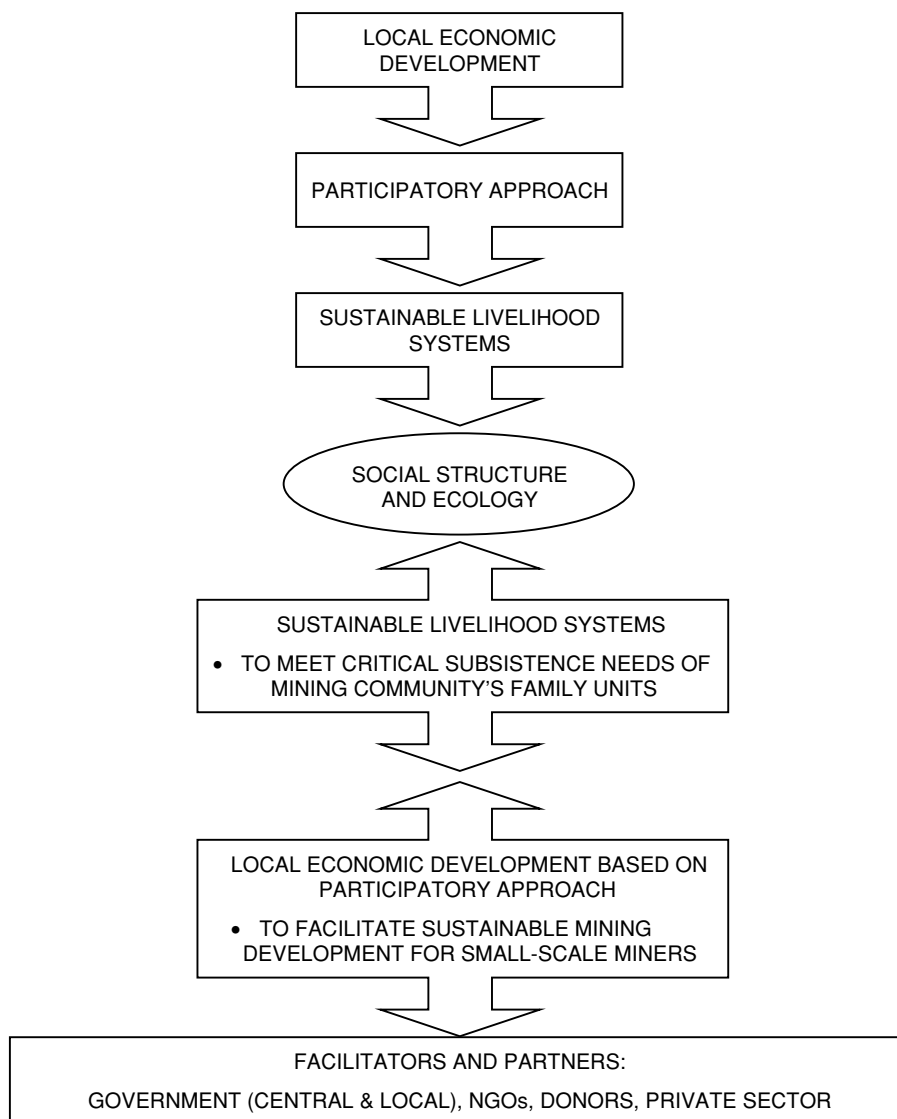
Unfortunately, the bureaucratic vicious circle of the national Government has compounded the ongoing process of impoverishment to nearly irreversible levels, as suggested by mounting evidence (UNDP, nd; World Bank, 1995; CIDA, 2000; ECLAC, 2000). Government authorities are unable to manage the conditions of small-scale and artisanal miners because they lack adequate resources to enforce existing regulations. This situation, in turn, facilitates more illegal operations, considerable environmental damage, unhealthy and unsafe labour standards and loss of fiscal revenue. Diminished fiscal revenues limit the Government’s ability to perform its regulatory functions, thus perpetuating the negative effects associated with small-scale and artisanal mining.

Nearly always, the recommended solutions to this conundrum have been: to strengthen public authorities; to use more efficient mining and processing techniques and appropriate technology; to disseminate information on environmental standards; and to rely on market mechanisms. Technological solutions have the potential to increase productivity and recovery and can lead to rising incomes, but they will not solve the immediate survival problems, particularly of the artisanal miners. The vicious circle must be broken if mining is to be associated with sustainable development and equitable human development. The implementation of sustainable livelihood possibilities geared to meet the survival needs of individual family is one option.

## **7. Redressing the process of impoverishment: an umbrella strategy**

As illustrated in Figure 1, sustainable livelihood can play a vital role in the process of solving social inequity among mining communities by providing alternatives within the framework of the participatory approach to development. It is through local participation that the development input, or the flow of outside resources, must link up with policies affecting the conditions of the communities under consideration.

<sup>18</sup> For instance, several years ago, USAID decided to entrust the execution of most of its projects to NGOs, instead of to governments. This example has been followed by several European bilateral assistance organizations.



**Figure 1.** Umbrella strategy to solve social inequity among mining communities

The institutional requirements for reversing the process of impoverishment are complex and rarely if ever concentrated in one organization. There are several actors and associated organizations, each as important as the next. Government (central and local), international organizations, NGOs and the private sector are stakeholders. All stakeholders, as facilitators and partners, must promote the institutional reforms needed to make mining more sustainable and more closely associated with human development. The primary key to this process is that local economic development must have the participation of all stakeholders.

It should be possible to outline boundaries for stakeholder efforts, within which strategies should be allowed to emerge. An umbrella strategy is intended to delineate the broad outlines but not its specific details (Mintzberg and Waters, 1998), much as an open-source operating system, a global team effort, that enhances its operational aspects.

Preliminarily, a two-pronged approach is suggested.

### *7.1. Application of the sustainable livelihood approach to meet subsistence needs of artisanal miners and their families*

Through a participatory approach, an assessment of the concerned mining communities can identify risks, assets, entitlements and indigenous knowledge found in the community. Coping and adaptive strategies should be reviewed in terms of the implications they have on the resource base. This assessment should incorporate the main factors of importance to the community, and should provide the basis for identifying alternative livelihood systems. Currently an identification of alternative livelihood systems for the Altiplano ecology is in progress (CIDA, 2000; UNDP, 1998a). The bulk of alternative livelihood systems are found to be in the core areas of agriculture and small livestock, with particular reference to varieties native to the Altiplano ecology. This effectively reduces health

and adaptive difficulties, while taking advantage of the native knowledge relative to the management of these species.<sup>19</sup> Thus, several efforts are now underway with a considerable degree of success (UNDP, 1998b): small irrigation schemes near the city of La Paz; rural micro enterprises in the northern Altiplano; women's cooperatives to raise community orchards near the city of El Alto; centres for training in trades open to men and women in Northern Potosí. In addition, in the mining centre of Huanuni, two NGOs are assisting with training in mediation skills, to reduce the level of violence at the community and household levels.

Given the Altiplano's specific historical evolution, the following aspects must be considered when designing alternative sustainable livelihood systems:

- It is essential to empower the communities with institutions that will link up with local government;
- No part of the community should be marginalized in any way. It must be clear from the start that the primary responsibility for directing an alternative sustainable livelihood system lies with the representatives of the local community;
- Participating experts, who design alternative sustainable livelihood systems, must be sensitive to the cultural and ecological conditions; some experts should come from institutions relevant to the community, such as local universities and research centres;
- Stakeholders must participate in meetings to ensure feedback; the entire community needs to be updated on the implementation of a strategy, either by traditional methods or by modern information technologies.

### *7.2. Identifying ways to facilitate sustainable development among small-scale miners, with emphasis on participatory local economic development*

When a community has to some extent secured alternative sustainable livelihoods for its artisanal miners, it may also want to retain some small-scale mining activities, which may require investment, at least in terms of time. For this step, partnerships with central and local government, NGOs,

small-scale miners associations, donor agencies and international mining companies will be needed.<sup>20</sup>

Overall, there is a window of opportunity for international mining companies, NGOs and local government to lead efforts towards local economic development based on the participatory approach. At the same time, there is a window of opportunity for those who decide to continue with small-scale mining. If properly organized, the anticipated activities can become the basis for sustainable mining development. Here, technological solutions will be productive. Stakeholders may be ready to take up training in the use of appropriate technologies for adequate environmental standards. Such training would prepare for more efficient techniques for production and processing, with the potential of increasing productivity and recovery, leading to rising incomes. Rising incomes would allow government to increase taxes and fiscal revenues. Access to funds would, in turn, allow government to perform its regulatory function, and thus break the bureaucratic vicious circle.

In order to formalize the work of small-scale miners, however, the process would need to address a host of interrelated issues. Specifically, these issues are linked to: technology (inefficient techniques and equipment); regulation (illegal trading and marketing); finance (lack of capital and investment opportunities); environment (degradation of soils); and social development (health/safety, child labour). Perhaps the most effective way to tackle these issues is to build capacity — simultaneously — for both small-scale miners and local government authorities (ECLAC, 2000). Although enterprise development and workers' organization would receive particular emphasis throughout the training cycle, the central areas of concentration would be: community participation and management; management capabilities (administration/accounting, labour relations, corporate management); and mining technology (environmental impact, mining geology, production/marketing principles).

<sup>19</sup> For example, the author visited field trials, conducted by the NGO San Silvestre de Letanías, for adapting vegetable production to the Altiplano ecology near the city of Viacha at an altitude of 3980 m above sea level. Since the Altiplano's climatic conditions allow only a short period for agricultural production, from October to May, rustic greenhouses have been tried successfully. These are built with adobe and plastic for about US\$ 200/unit. This effectively can bring not only a second crop but also can make vegetable production economically viable. Under these circumstances, the investment and production cost can be repaid quickly, given the vegetable demand in the urban centres of La Paz and Oruro. It is also possible to complement this production with small livestock, such as guinea pig or rabbit. These are inexpensive to raise, and could provide both an important source of animal protein and a considerable business opportunity for women and children.

<sup>20</sup> The potential "win win" situation of this approach can be illustrated by the results of Inti Raymi S.A. in Bolivia in the early 1990s. When Inti Raymi officials rang the bells of Chuquina to call a town meeting, only two people showed up. Most of the residents had moved in search of jobs. In nearby La Joya, only 25 residents survived by farming and artisanal mining. All this changed when Inti Raymi agreed with villagers to relocate the mine and the village of Chuquina. It supplied materials and architects for new homes, schools, church, government buildings and a hospital. It also brought in water, sewers and electricity, a new school, a remodeled church and a first-aid clinic in return for community-owned land in La Joya. It also established the Inti Raymi Foundation endowed with US\$ 1.8 million for community projects, introducing better strains of grain and livestock, improving water systems and building 14 schools. By 1993, the Chuquina population was back to 500 and La Joya to 1000, mostly because of the work at the mine. All but two of the 550 jobs were held by Bolivians. As COMIBOL had laid off most of its work force, Inti Raymi was able to recruit the country's best mining engineers and geologist to ensure an early start up. The mine workers averaged US\$ 400 a month, four times a factory worker's wage. Although the company invested approximately US\$ 235 million, low labour costs have kept cash operating costs low (Wall Street Journal, 1993).

Despite the successful efforts of some donors and private investors throughout the Altiplano to further alternative livelihood options, the implementation and formalization process promises to be very challenging from the organizational and management standpoint. One constraint is the incomplete data on the number and distribution of both artisanal and small-scale miners. As this information becomes available, through projects in the Altiplano, it will become possible to identify procedures for the formalization process. One way to organize small-scale miners would be through the *Camara de Minería*. As indicated, those of La Paz and Oruro have been actively engaged in organizing small-scale miners to take advantage of technical assistance and potential linkages for investment in exploration with Canadian junior mining companies (CIDA, 2000). Linking up with external sources of investment from the private sector is essential. Donors can be extremely useful in brokering national efforts to attract foreign private capital. The successful results of the Inti Raymi S.A. foreign mining investment serves to illustrate the viability of this option.

## 8. Conclusion

The process of impoverishment of the mining communities of the Bolivian Altiplano has been difficult to reverse, in particular in view of the Government's own bureaucratic vicious circle. The lack of attention to these communities operating with limited managerial capabilities has generated costly political conflicts and continues to damage the environment. Remedial action has so far been inadequate and unrealistic.

Government (local and central), the private sector, NGOs and donors need to consider a programme to promote the institutional reforms required to introduce sustainable mining development, as facilitators and partners. This programme should have a time frame and be continuously monitored and evaluated. As outlined above, the programme should first focus on sustainable livelihoods adequate to ensure the subsistence needs of individual families. Then, to the extent that the first phase has been successfully achieved, some miners may decide to continue working in small-scale mining activities. In such cases, their access to resources and capacity building must be facilitated. At the end of the day, it is the reduced pressure on mineral resources stemming from a wider availability of sustainable livelihoods that will increase the viability of sustainable small-scale mining. A decrease in political violence throughout the sector will enable stakeholders to consider foreign direct investment within the framework of Bolivia's sustainable human development goals.

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## References

- Arpin, M., 1999. *Le secteur minier en Bolivie-Octobre 1999 (mimeo) Proyecto de asistencia en la reforma de la minería y del medio ambiente en Bolivia*. CIDA/ACDI, La Paz.
- Ayub, M., Hashimoto, H., 1984. *The Economics of Tin Mining in Bolivia*. World Bank, Washington, D.C.
- Barraclough, S., 1973. *Agrarian Structure in Latin America*. Lexington Books, Toronto.
- Braudel, F., 1975. *The Mediterranean and the Mediterranean World in the Age of Philip II*. 2 vols, Harper Torchbooks, New York.
- Braudel, F., 1979. *Civilisation matérielle, économie et capitalisme XV–XVIII siècle*. 3 vols. Armand Colin, Paris.
- Canadian International Development Agency CIDA/ACDI, 2000. *Evaluación de término medio del Proyecto de asistencia en la reforma de la minería y del medio ambiente en Bolivia*. CIDA/ACDI, Ottawa.
- Chungara, D.B., 1981. *Domitila: Si on me donne la parole... La vie d'une femme de la mine bolivienne. Témoignage recueilli par Moema Viezzer*. Petite collection maspero, Paris.
- Contreras, M., 1990. Debt, taxes and war: the political economy of Bolivia, c. 1920–1935. *Journal of Latin American Studies*, 22(2): 265–284.
- Crowson, P., 1997. Mining during the next 25 years: issues and challenges. *Natural Resources Forum*, 21(4): 231–238.
- Centro de Estudios y Proyectos, S.R.L. (CEP), 1999. *Cochabamba, Potosí, Tarija, Chuquisaca: Pobreza, género, medio ambiente*. Embajada Real de los Países Bajos, La Paz.
- Centro de Promoción Minera (CEPROMIN), 1996. *El trabajo invisible de la mujer minera boliviana*. Centro de promoción minera, La Paz.
- Economic Commission for Latin America and the Caribbean (ECLAC), 2000. *La llamada pequeña minería: un renovado enfoque empresarial*. División de Recursos Naturales e Infraestructura. Santiago de Chile. June.
- Fonseca, C., 1973. *Sistemas económicos andinos*. Biblioteca Andina, Lima.
- Fox, D., 1999. *Mining Journal Annual*, pp. 122–123. The Mining Journal, London.
- Gomez, W., 1976. Bolivia: problems of a pre- and post-revolutionary export economy. *Journal of Developing Areas*, 10: 461–484.
- Klein, H.S., 1982. *Bolivia: The Evolution of a Multi-ethnic Society*. Oxford University Press, New York.
- Kosok, P., 1965. *Life and Water in Ancient Peru*. Long Island University Press, New York.
- Lele, U., 1975. *The Design of Rural Development: Lessons from Africa*. World Bank Research Publication. The World Bank, Washington, D.C.

- Mitchell, P., 1981. La agricultura de riego en la sierra central de los Andes: Implicaciones para el desarrollo del estado. In: Lechtman, H., Soldi, A.M. (Eds.) *La tecnología en el mundo andino*. Universidad Autónoma de México, México.
- Mintzberg, H., 1996. Managing government governing management. *Harvard Business Review*, May–June. Reprint 96306.
- Mintzberg, H., Waters, J., 1998. Of strategies, deliberate and emergent. In: Segal-Horn, S. (Ed.) *The Strategy Reader*. The Open University, Blackwell.
- Murra, J., 1975. *Formaciones económicas y políticas del mundo andino*. Instituto de Estudios Peruanos, Lima.
- Nash, J., 1979. *We Eat the Mines and the Mines Eat Us*. Columbia University Press, New York.
- Nash, J., 1992a. *I Spent My Life in the Mines: The Story of Juan Rojas, Bolivian Tin Miner*. Columbia University Press, New York.
- Nash, J., 1992b. Interpreting social movements. Bolivian resistance to the economic conditions imposed by the International Monetary Fund. *American Ethnologist*, 19(2): 275–293.
- Organization for Economic Cooperation and Development (OECD), 1991. *Development Aid Committee's Report*. OECD, Paris.
- Sawada, K., nd. Sustainable development in non-renewable resources and the role of the United Nations. Mimeo, New York.
- Smith, C.T., Denevan, W.M., Hamilton, P., 1981. Antiguos campos de camellones en la región de Lago Titicaca. In: Lechtman, H., Soldi, A.M. (Eds.), *La tecnología en el mundo andino*. Universidad Autónoma de México, México.
- Thorp, R., 1998. *Progress, Poverty and Exclusion. An Economic History of Latin America in the 20<sup>th</sup> Century*. Inter-American Development Bank. Washington, D.C.
- UNDP, nd. Artisanal mining and sustainable livelihoods. Draft. United Nations Development Programme, New York.
- UNDP, 1990. *Human Development Report*. Oxford University Press, New York.
- UNDP, 1991. *Human Development Report*. Oxford University Press, New York.
- UNDP, 1992. *Human Development Report*. Oxford University Press, New York.
- UNDP, 1997. *Participatory Local Governance*. Technical Advisory Paper 1. United Nations Development Programme, New York.
- UNDP, 1998a. *Desarrollo humano en Bolivia 1998*. United Nations Development Programme (PNUD), La Paz.
- UNDP, 1998b. Proceedings of the workshop on the sustainable development of non-renewable resources towards the 21<sup>st</sup> century. United Nations Development Programme, New York, 15–16 October.
- United Nations & GTZ, 1992. *Mining and the Environment. The Berlin Guidelines*. Mining Journal Books Ltd, London.
- World Bank, 1988. *Rural Development: World Bank Experience, 1965–1986*. The World Bank, Washington, D.C.
- World Bank, 1995. *Setting Priorities for Remediation of Environmental Problems Due to Mining in Bolivia*. The World Bank, Washington, D.C.
- World Bank, 1999. *An Environmental Study of Artisanal, Small, and Medium Mining in Bolivia, Chile, and Peru*. Technical paper No. 429. The World Bank, Washington, D.C.
- Wall Street Journal, 1993. U.S. mining firms, unwelcome home, flock to Latin America. 18 June.